Pacific Gas and Electric Company®

Yvonne J. Meeks
Site Remediation - Portfolio Manager
Environmental Affairs

6588 Ontario Road
San Luis Obispo, CA 93405

Mailing Address
4325 South Higuera Street
San Luis Obispo, CA 93401

805.546.5243
Internal: 664.5243
Fax: 805.546.5232
Internet: YJM1@pge.com

April 14, 2004

Lisa Anderson
Program Manager
Metropolitan Water District of Southern California
700 North Alameda St.
Los Angeles, CA 90012

Subject: Preliminary Concepts for Soil-Bentonite Cutoff Wall
PG&E Topock Compressor Station, Needles, California

Dear Ms. Anderson:

In response to our meeting on March 25, 2004, enclosed is a technical memorandum describing the preliminary concepts for the design and implementation of a soil-bentonite cutoff wall at Topock. During this phase of drilling and investigation, as part of the current Interim Measures, PG&E is collecting additional data in support of the preliminary evaluation of a subsurface physical barrier. We look forward to your input on this important project. Please contact me at (805) 546-5243 if you have any questions or would like to discuss this in greater detail.

Sincerely,

Terri Hesson
for Yvonne Meeks

Enclosure

cc: John Clairday

Preliminary Concepts for Soil-Bentonite Cutoff Wall

Topock Compressor Station, Needles, California

DATE: April 14, 2004

Pacific Gas and Electric Company (PG&E) is undertaking an expedited analysis of the feasibility of installing a barrier wall at Topock. As part of that analysis, this memorandum provides preliminary concepts for the design and implementation of a soil-bentonite cutoff wall.

PG&E is collecting additional data in support of this evaluation. This memorandum provides preliminary concepts for a soil-bentonite cutoff wall (SBCW), descriptive information about SBCW construction methods, and recommendations for further evaluation.

A more rigorous analysis of the barrier wall options, including evaluations of other types of the physical barrier technologies, will consider the following federal and state evaluation criteria:

- Protective of human health and environment
- Constructability / technical feasibility
- Long-term reliability and effectiveness
- Short-term effectiveness
- Time to achieve remedial goals
- Cost
- Potential environmental impacts
- Public acceptance
- Reduction in toxicity, mobility and volume
- Health and safety risks
- Surface impacts
- Permitting / regulatory implementability
- Compatibility with existing interim measures and long-term remedies

Based on a preliminary review of site-specific information, a SBCW could be installed at the site to play an important role as part of the ultimate remedy. Using Topock data, it appears that installation of a SBCW is a feasible option, given the following:

- Ground conditions are favorable (unconsolidated granular deposits, and groundwater at some depth below the ground surface);
- The site is reasonably level (some grading will be required);

- Soil-bentonite backfill is probably compatible with the site groundwater quality and conditions;
- The depths are within the range of available equipment.

A SWCB offers several advantages over other types of physical barriers:

- The construction method is well established.
- The expected hydraulic conductivity is typically 10^{-7} cm / sec or less.
- An SBCW is flexible, suitable for use in areas of seismic activity.
- An SBCW is homogeneous; no special joints are required.
- An SBCW is composed of natural materials that are resistant to weathering; in general, only conditions of very high or low pH, very high sodium concentration, or the presence of free-phase chlorinated organic solvents are incompatible with SBCWs.

Preliminary Concepts

The SBCW is proposed to be placed from the ground surface to the top of the Red Fanglomerate. A key trench will be installed if the fanglomerate is suitable for excavation. Geophysical testing will be conducted to determine how effectively the wall can be keyed into the Red Fanglomerate to prevent seepage under the wall.

A wall width of 36 inches is proposed for the Topock site at this conceptual stage, based on the width of other SBCWs of comparable depths.

The attached Sketch 1 shows a conceptual alignment. The conceptual alignment was selected based on the following assumptions:

- The wall should be kept a distance of about 100 feet from the edge of the Colorado River to reduce the potential impacts of the river level fluctuations on trench stability. The preliminary offset of 100 feet was chosen based on the desire to keep the river out of the influence zone of the trench, which is typically assumed to be above a sloping plane extending upward from the bottom of the trench. The slope is assumed to vary between 1:1 (horizontal:vertical) to 1:2. Because of the potential depth of the trench (100 feet or more), the proximity of the river, and the necessity to ensure against slope failure during construction, the more conservative slope of 1:1 was chosen for the conceptual alignment.
- The wall would be constructed beyond the leading edge of known Cr(VI) contamination in excess of background concentrations, to the extent feasible.
- The wall may be limited by the Burlington Northern Santa Fe Railroad (BNSF) trestle foundations, which are of unknown type and condition.

Based on the grain-size data currently available, the native site materials are expected to form a broadly graded granular material if mixed together. A broad gradation is ideal for preparing a soil-bentonite backfill mixture. It may be necessary to import a limited amount of fines (i.e., material passing the No. 200 sieve) to provide a suitable backfill mixture. This would be determined by performing a mix design.

A working platform about 100 feet wide will be required for SBCW installation. This width is required to accommodate the excavation and mixing equipment, access roads, slurry lines, excavated material stockpiles, and width for mixing and placing backfill. The working platform will have to be approximately level (*i.e.*, maximum slope of about 1 percent) from north to south to contain the slurry within the trench.

The working platform will be constructed using an imported plastic soil ("clay"). This is required to keep the top of the trench from raveling during the excavation and backfilling processes. The surface dredged sand located in the floodplain is unsuitable for construction of the working platform. If additional fines are required, they can be placed on the working platform, or the upper portion of the working platform may be constructed of the additional fines.

A staging area will be established for an onsite office, equipment, maintenance areas, parking, material storage, etc. Slurry will be produced using high-shear mixers capable of nearly completely hydrating the bentonite during mixing, eliminating the need for hydration ponds.

The working platform and staging areas will be removed and the areas restored after wall installation.

Integrated Hydraulic Control

SBCW technology should be combined with hydraulic control to create an integrated groundwater control system. At the Topock site, the hydraulic control would consist of groundwater extraction from wells to create an average inward (westward) gradient.

In this way, the SBCW may improve the performance of the groundwater extraction system. It would also truncate more conductive zones (*e.g.*, clean sand lenses, sand channels) that might otherwise be more difficult to control using groundwater extraction alone. It would also limit the amount of Colorado River water potentially drawn into the site.

Hydraulic control using a groundwater extraction system could also be provided in areas where it is not feasible to construct a SBCW due to physical constraints such as the railroad or Interstate 40 bridge foundations.

The physical barrier technology will result in near-complete hydraulic decoupling of the groundwater on the east and west sides of the SBCW. Groundwater to the east of the SBCW will not be drawn to the hydraulic control system.

SBCW Construction Methods

SBCWs have been used for decades in the construction industry for groundwater control. Starting in the early 1980s, SBCWs have been used at numerous sites for control of contaminated groundwater. The practical excavation depth continues to increase as new equipment is developed. At present, SBCWs can be excavated to about 85 feet using specialized hydraulic excavators, and to depths in excess of 140 feet using specialized crane-operated clamshells.

A SBCW is installed in two steps: excavation and backfill. The trench is excavated using the slurry method of excavation. The slurry method of excavation is conceptually simple: a slurry of bentonite and water is mixed and allowed to hydrate. A trench excavation is then started, and as material is removed from the trench, slurry is supplied to the excavation to replace the volume of the material removed. The level of the slurry is kept close to the ground surface, and generally at least 3 feet above the elevation of any groundwater present.

Under these conditions, the slurry exerts hydrostatic pressure on the walls of the trench, which supports the trench walls. The hydrostatic pressure of the slurry also forces some of the water from the slurry into the trench walls. If the walls are composed of fine-grained soil (clay, silt, or sand), a “filter cake” will form on the walls, reducing further loss of water from the slurry. If the walls are composed of coarse-grained soil (coarse sand, gravel, or cobbles) some of the slurry will flow into the soil voids in the walls. In most cases, the flow will reduce as the slurry penetrates the gravel and thixotropic gel strength develops. In extreme cases, slurry loss will continue, and other means such as the use of bridging or plugging materials must be used to reduce the slurry loss.

Once the trench has been advanced to the desired depth and the length is sufficient to prevent the backfill from running to the point of excavation, backfill will be placed. The SBCW backfill will consist of a mixture of soil, bentonite, and water. A typical backfill mix is a well-graded material, with a maximum particle size of 2 ½ to 3 inches, and 20 to 40 percent by weight passing the No. 200 sieve.

The backfill is manufactured on site, using the same water and bentonite used for the slurry. Whenever possible, soil excavated from the trench is used for backfill manufacture. It is supplemented by other added soil materials if necessary to provide the proper gradation. If the excavated soil is unsuitable for use in backfill manufacture, borrow materials from a suitable source will be used. It may be necessary to segregate some of the materials excavated from the trench into “suitable” and “unsuitable” categories. For example, boulders and large broken rock fragments are unsuitable for backfill, and are commonly segregated from the balance of the excavated materials. At the Topock site, it is likely that the excavated materials (except possibly for the Red Fanglomerate) can be used for the backfill.

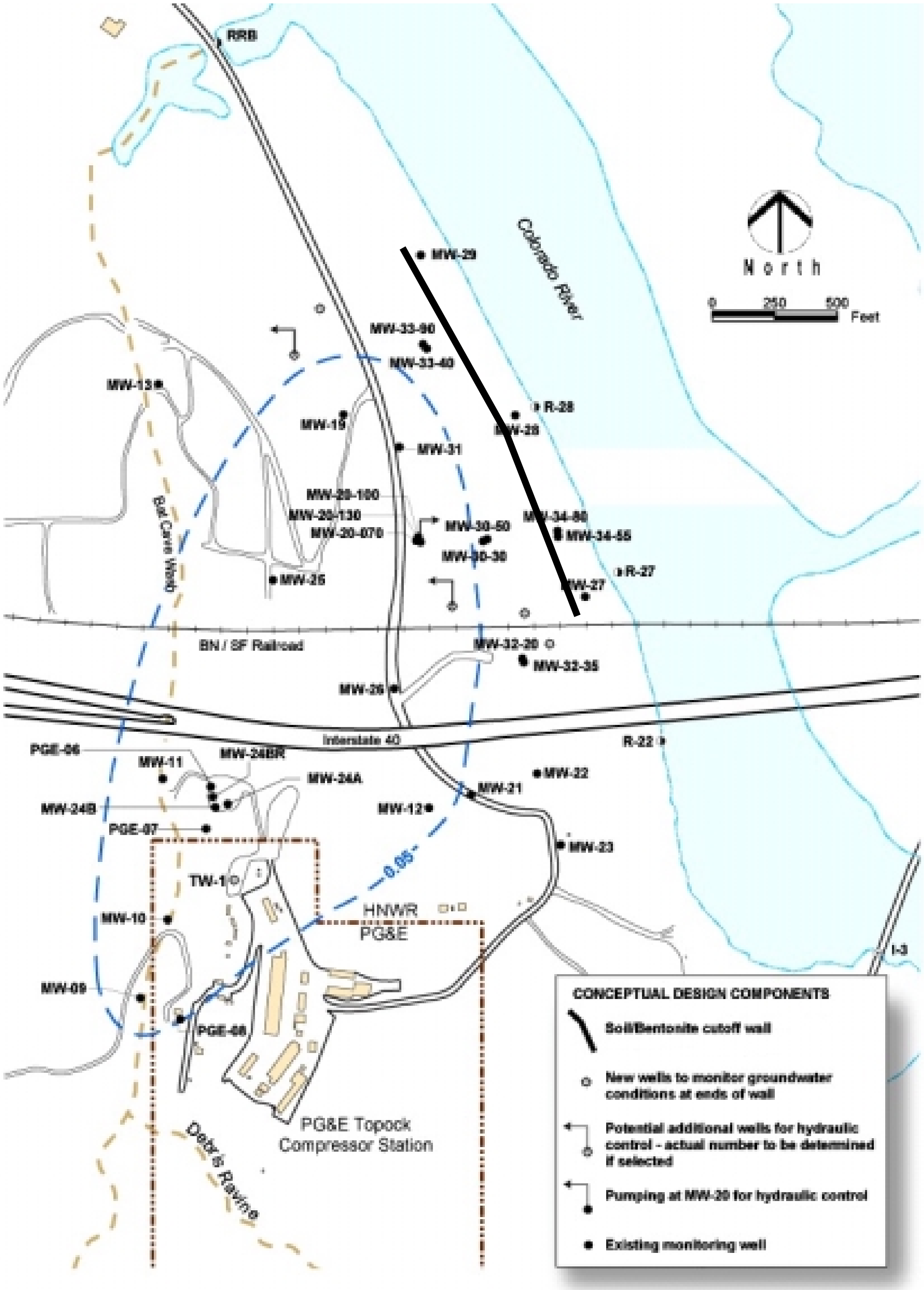
After initial backfilling of the SBCW is completed, the surface of the backfill is allowed to settle for 2 to 4 weeks. The dried backfill material at the surface is then removed and the top of the wall is permanently covered to prevent long-term drying and to permit surface travel over the top of the wall. The surface completion is typically constructed using a geotextile and earth fill.

Further Evaluation

To assess the feasibility of constructing an SBCW at the Topock site, a thorough evaluation of the subsurface is needed. The following data gathering activities are underway:

1. Gather information regarding subsurface conditions during the current drilling program. Specifically:
   a. Define the depth to bedrock at additional locations.
   b. Obtain samples for grain-size analysis and Atterberg limits tests.
   c. Record information regarding difficulty of drilling in the Red Fanglomerate to assess the potential for excavating a key trench into the Red Fanglomerate.
2. Define seismic compressional and shear velocities in the various subsurface strata, including the Red Fanglomerate, during refraction and reflection geophysical investigations.
3. Identify potential sources of plastic soil (“clay”) borrow materials.
4. Research foundation conditions for the BNSF and I-40 bridges.

If the results of the data evaluation indicate that there is no apparent technical impediment to constructing an SBCW at the site, a conceptual design for the wall would be prepared, with the mix design and compatibility testing performed using materials obtained from the site, commercial bentonite, representative imported fines (if required), and groundwater from the site.



SKETCH 1
CONCEPTUAL LAYOUT
SOIL/BENTONITE CUTOFF WALL
TOPOCK SITE
NEEDLES, CALIFORNIA